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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

BRADY et al Atty. Ref.: **117-365**

Serial No. **Unknown** Group:

National Phase of: **PCT/GB00/01020**
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Filed: **September 19, 2001** Examiner:

For: **METHOD AND APPARATUS FOR IMAGE PROCESSING**

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September 19, 2001

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

PRELIMINARY AMENDMENT

Prior to calculation of the filing fee and in order to place the above identified application in better condition for examination, please amend the claims as follows:

IN THE CLAIMS

Please cancel claims 1 through 23 and substitute new claims 24 through 43 as follows:

24. (New) A method of processing image data of a plurality of time-separated images of a non-rigid body to detect movement of the body, comprising the steps of:-

for each of a plurality of sampling points in each image calculating and storing a plurality of candidate movements together with the estimated probability of each candidate;

iteratively recalculating for each sampling point the probability of each of the candidate movement based on the stored probability of that candidate movement and the probabilities of the candidate movements at other sampling points; and

generating from the recalculated probabilities a motion field indicative of the non-rigid body movement.

25. (New) A method according to claim 24, wherein the other sampling points are the neighbouring sampling points.

26. (New) A method according to claim 24, wherein the sampling points correspond to unit areas containing a set of pixels of the image.

27. (New) A method according to claim 24, wherein the plurality of candidate movements and their probabilities are calculated by calculating a similarity measure indicating the similarity of each sampling point to sampling points in the preceding image, and normalizing the similarity measures to sum to unity, the normalised similarity measures being stored as said probabilities, and the candidate movements are the corresponding vector displacements which map the sampling point to the respective sampling points in the preceding image.

28. (New) A method according to claim 27 wherein the similarity measure is selected from mutual information, normalised mutual information, entropy correlation coefficient and centered cross correlation.

29. (New) A method according to claim 24, wherein the iterative recalculation of the stored probabilities comprises multiplying each stored probability by the product of the stored probabilities for the neighbouring sampling points.

30. (New) A method according to claim 29 wherein the iterative recalculation of the stored probabilities comprises multiplying each stored probability by the product of the respective maxima of the stored probabilities for the neighbouring sampling points.

31. (New) A method according to claim 29 wherein the iterative recalculation of the stored probabilities comprises multiplying the stored probability for each candidate movement at each sampling point by the product of the respective maxima of the stored probabilities for the neighbouring sampling points, the maxima being weighted according to the difference between said candidate movement and the respective stored movements corresponding to the maxima.

32. (New) A method according to claim 31 wherein the weighting is Gaussian.

33. (New) A method according to claim 24 wherein the iterative recalculations of the probabilities for the movements at each sampling point use only movements at neighbouring sampling points which are judged to be similar to the said movements at each sampling point.

34. (New) A method according to claim 33 wherein movements are judged to be similar if the difference in magnitudes of the displacements caused by the movements is less than a preset amount.

35. (New) A method according to claim 24 wherein the number of iterations is set according to the distance between salient points in the image.

36. (New) A method according to claim 24 wherein the motion field is generated by selecting as the movement at each sampling point the candidate movement having the maximum probability after said iterative recalculation.

37. (New) A method according to claim 36 further comprising the step of correcting the plurality of images for the movement by applying thereto a transformation based on the motion field, and then repeating the method of claim 13 using differently spaced sampling points to generate a new motion field.

38. (New) A method according to claim 37 wherein the transformation is calculated by fitting a parametric transformation to the motion field.

39. (New) A method according to claim 37 wherein the steps of correcting the plurality of images for the movement and then repeating the method of claim 13 using differently spaced sampling points, are carried out iteratively with successively more closely spaced sampling points.

40. (New) A method according to claim 24 wherein the images are a sequence of magnetic resonance images of a body taking up a contrast agent.

41. (New) A method according to claim 24 wherein the images are a sequence of magnetic resonance images of a human breast taking up a contrast agent.

42. (New) Apparatus for processing image data of a plurality of time-separated images of a non-rigid body to detect movement of the body, comprising:

calculating means for calculating for each of a plurality of sampling points in each image a plurality of candidate movements together with the estimated probability of each candidate;

storage means for storing said candidate movements and estimated probabilities;

recalculating means for iteratively recalculating for each sampling point the probability of each of the candidate movement based on the stored probability of that candidate movement and the probabilities of the candidate movements at other sampling points; and

motion field generating means for generating from the recalculated probabilities a motion field indicative of the non-rigid body movement.

43. (New) A computer program storage medium readable by a computer system and encoding a computer program for controlling a computer to process image data of a

plurality of time-separated images of a non-rigid body to detect movement of the body by a method comprising the steps of:-

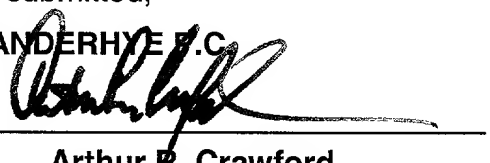
for each of a plurality of sampling points in each image calculating and storing a plurality of candidate movements together with the estimated probability of each candidate;

iteratively recalculating for each sampling point the probability of each of the candidate movement based on the stored probability of that candidate movement and the probabilities of the candidate movements at other sampling points; and

generating from the recalculated probabilities a motion field indicative of the non-rigid body movement.

REMARKS

Entry of the newly presented claims and examination based thereon is requested.

Respectfully submitted,
NIXON & VANDERHYE P.C.
By: 

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